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(11) **EP 0 853 018 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
15.07.1998 Bulletin 1998/29

(51) Int. Cl.<sup>6</sup>: **B60N 2/28**

(21) Application number: **98100028.4**

(22) Date of filing: **02.01.1998**

(84) Designated Contracting States:  
**AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC  
NL PT SE**  
Designated Extension States:  
**AL LT LV MK RO SI**

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(30) Priority: **08.01.1997 JP 1170/97**  
**22.10.1997 JP 289733/97**

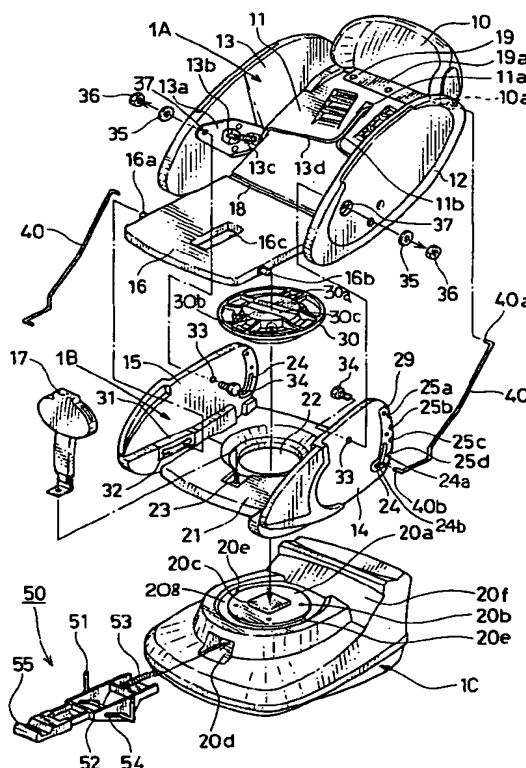
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(54) **Vehicular child safety seat**

(57) A vehicular child safety seat realizes a position in which a seat portion (16) and a backrest (11) are substantially coplanar in a horizontal state when the backrest (11) is reclined backwards at the most reclined state to form a bed plane on which a child is laid, and a position in which the backrest (11) is most upright with respect to the seat bottom (16). A seat main body 1B is attached to a base body 1C in a rotatable manner. Thus, a vehicular child safety seat can be provided that can be used constantly throughout the entire childhood for a baby, an infant, and a child of school age.

FIG. 2



## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

The present invention relates to a vehicular child safety seat placed on a seat of a vehicle and fastened to the seat of the vehicle using a seat belt with which the vehicle is equipped.

#### Description of the Background Art

In these few years where safety measures have emerged as a critical factor for vehicles, various vehicular child safety seats have been developed as a device for insuring the safety of a new-born baby, a baby, an infant, and a child of school age (referred generically as "child" hereinafter) riding in a vehicle.

The Japanese Industrial Standard has established detailed standards in "Vehicle Equipment-Child Protection Device: JIS-D 0401-1996" with respect to a vehicular child safety seat.

According to the type and classification of a child restrains by the Japanese Industrial Standard, the type of a child protection device is classified into "baby (including new-born baby) bed", "infant seat (for both forward and rear facing directions)" and "child seat". The classification is divided according to the weight range of the child, i.e., W1 (less than 10kg), W2 (at least 9kg and less than 18kg), W3 (at least 15kg and not more than 25kg), and W4 (at least 22kg and not more than 36kg). In order to satisfy the safety requirements for the classes of W1 and W2, an infant seat, when used in a rear facing direction with respect to the direction of travel, must have the mechanism to prevent the tilted angle of the backrest, i.e., the angle of the surface of the backrest to the vertical plane, from exceeding the maximum of 60 degrees at the time of a crash accident on account of the rebound of the infant seat.

In general, the child protection apparatus for W1 refers to an apparatus fixed to the seat of a vehicle in a direction lateral or facing rearward with respect to the direction of travel of a vehicle for babies aged 0-10 months. The child protection apparatus for W2 refers to an apparatus fixed to a seat of a vehicle in a frontward or backward facing direction with respect to the direction of travel of the vehicle for infants from 6 months to 3 or 4 years (commercially available as a "child seat" in general). The child protection apparatus for W3 refers to an apparatus for elevating the seat bottom plane for a child aged 3 or 4 years to 6 years (commercially available as "booster" in general).

Various products have been developed as devices to be applied to vehicular child protection apparatuses for W1, W2 and W3.

The rate of usage of a child protection apparatus in the Japanese car society is extremely lower than that

compared to US and European countries. The first factor can be ascribed to the lack of the parents in recognizing the danger associated with vehicles. Furthermore, if a child shows his/her reluctance in being seated in the child protection apparatus, there is a possibility that the child protection apparatus will not be used. These all come from the lack of danger appreciated by adults associated with vehicles.

In view of the foregoing, it is first necessary to reform the recognition of adults as to the danger associated with automobiles. Aggressive official activities by the government is expected. The problem of a child showing reluctance to use a child protection apparatus can be obviated more or less by always having a child seated in the child protection apparatus ever since his/her babyhood, i.e., before a baby begins to take notice so that the child will take it for granted that a child protection apparatus must be used when riding in a car.

This is extremely important from the social point of view. Thus, a child protection apparatus that can be used consistently from babyhood to school age is desired in order to inculcate the habit and recognition of always using a child protection apparatus for children riding in a car. In other words, a child protection apparatus is desired that commonly corresponds to the specification of all the above-described W1 to W3.

However, child protection apparatuses currently available on the market are only solitary products for W1, W2, W3, independently, or a product that has a rotatable seat and a reclinable backrest as disclosed in Japanese Patent Laying-Open No. 1-113007. There is no product that can be commonly used for W1 and W2, or for W1 to W3. Although the vehicle infant restraint seat disclosed in the aforementioned Japanese Patent Laying-Open No. 1-113007 seems to be available for consistent usage for W1 and W2 in common, this seat apparatus is intended for only infants and children. It is not suitable for small babies and infants, particularly those in supine and prone positions. This is because the apparatus, when taking a bed-like flat position by reclining the backrest portion, has its head portion open with inadequate support for babies to be laid on the apparatus. This restraint seat does not have the requirements for W1.

### SUMMARY OF THE INVENTION

An object of the present invention is to provide a vehicular child safety seat that can be consistently used for children of various ages from babyhood to childhood.

According to an aspect of the present invention, a vehicular child safety seat is fixed to a seat of a vehicle using a seat belt with which the vehicle is equipped, and has a support plane for supporting a child. The support plane is provided in a selectable manner of a state forming a bed plane enclosing the head and side portions of a child for laying the child transverse to the direction of travel of the vehicle, and a state forming a seat plane for

seating the child facing forward or rearward with respect to the direction of travel of the vehicle.

According to the vehicular child safety seat of the above-described structure, the child can be laid traverse to the direction of travel of the vehicle. Usage corresponding to W1 is allowed by forming a bed plane enclosing the head and side portions of the child. Also, usage for W2 is allowed by forming a seat plane for seating the child facing frontward or rearward to the direction of travel of the vehicle.

Thus, the vehicular child safety seat of the present invention can be used in common from babyhood to childhood.

According to another aspect of the present invention, a vehicular child safety seat is implemented by a seat device including a seat bottom, a backrest provided reclinable with respect to the seat bottom, a pair of side guards extending from both sides of the backrest and substantially perpendicular to the front side surface of the backrest, a head guard attached at the upper end of the backrest in an angular orientable manner to the front side surface of the backrest.

According to the above structure, the top and sides of the head and the sides of the body of a child can be protected in a safety and comfortable state to improve the safety of the child in a vehicle.

According to a further aspect of the present invention, the above vehicular child safety seat further includes a support device and a base. The support device includes a pair of arm rests at the inner side and in close proximity to the pair of side guards for supporting the pair of side guards in a backward and frontward rotatable manner about the support point, and a connection plate connecting the lower ends of the pair of arm rests. The base includes a hold device for holding the support device in a rotatable manner in a substantially horizontal direction.

According to the above structure, the side body of the child can be protected sufficiently. Also, by the reclinable backrest and the support device rotatable with respect to the base, the support device can be realized in a direction transverse, forward, or rearward with respect to the direction of travel of the vehicle.

In the above vehicular child safety seat, the seat device is provided detachable to the base.

By this structure, the vehicular child safety seat can be used for W3.

In the above vehicular child safety seat, the hold device preferably includes a circular convex portion provided at the base, a through opening provided in the connection plate for receiving the convex portion, and a support plate sandwiching the connection plate with the base and secured to the convex portion so that the connection plate is rotatable.

By providing the support device rotatable with respect to the base, the support device can be implemented in a more preferable form in the transverse, forward or backward direction with respect to the direction

of travel of the vehicle.

In the above vehicular child safety seat, the hold device and the backrest preferably has a backrest inclination limit device provided to allow the backrest to be reclined when the seat device is in a transverse position, and to prevent the backrest from reclining in an attempt to recline the backrest when at positions other than the transverse position of the seat device.

The provision of the backrest inclination limit device allows the mechanism to be realized of preventing the tilted angle of the backrest position, i.e. the angle between the surface of the backrest and the vertical direction exceed the maximum of 60 degrees at the time of a crash accident taking into consideration the rebound of the vehicular child safety seat at the time of collision when the vehicular child safety seat is used as a backward facing infant seat.

In the above vehicular child safety seat, the backrest inclination limit device preferably includes an engagement projection provided in the proximity of the lower end portion of the backrest at the rear side, a concave groove provided at the support plate extending in the lateral direction that can receive the engagement projection so that the backrest can be inclined when the seat device is in the transverse state, and an abutment plane for preventing the reclining of the backrest by abutting against the engagement projection in an attempt to recline the backrest in a state other than in the transverse state.

According to the above structure, the space of the vehicular child safety seat can be used effectively. Also, when the vehicular child safety seat is used as a rearward facing infant seat, the mechanism can be realized to prevent the tilted angle of the backrest portion from exceeding the maximum of 60 degrees at the time of a collision taking into consideration the rebound of the vehicular child safety seat.

In the above vehicular child safety seat, the engagement projection is preferably provided so as to be received in the concave groove to prevent the rotation of the seat device relative to the base when the seat device is in a transverse state.

According to this structure, rotation of the seat device relative to the base can be prevented when the seat device is in a transverse state used as a bed. Thus, the safety in the usage as a bed can be improved.

According to still another aspect of the vehicular child safety seat of the present invention, the pair of side guards and the pair of armrests are arranged to have a portion thereof overlapping each other.

By this structure, the side portion of the child can be protected by a double structure of at least the side guard and the armrest. Particularly in the case where the vehicular child safety seat is used as a bed in the traverse state, the safety at the time of a crash accident can be improved.

According to yet a further aspect of the vehicular child safety seat of the present invention, the seat bot-

tom is supported by the pair of armrests so that the seat bottom slides towards the backrest as the backrest is moved upwards.

According to this structure, the seat bottom slides backwards as the backrest is moved to its upright position even when the child is transposed to a sitting position from a lying position. Therefore, any drag or pulling of the clothing and the like at the back of the child is eliminated. The child can be moved from a lying position to a sitting position in a natural manner.

Preferably, the above vehicular child safety seat further includes a crotch belt passing through an elongated hole provided in the seat portion along the sliding direction of the seat portion and fastened to the connected plate.

By this structure, the distance between the backrest and the crotch belt is increased when the seat portion slides backwards as the backrest is moved upright since the crotch belt is fastened to the connection plate. When the crotch belt is used as a 5 point seat belt together with a pair of shoulder belts and a pair of lumbar belts in a preferable embodiment, the child user will feel no oppressive sensation even when transposed from a lying position to a sitting position. A comfortable posture can be provided.

In yet another aspect of the vehicular child safety seat of the present invention, the base further includes a seat fixation device for selectively fixing the rotary orientation of the seat device to the base.

By this structure, the vehicular child safety seat can be secured in a transverse, forward-facing or backward-facing state with respect to the direction of travel of the vehicle.

According to yet another aspect of the vehicular child safety seat of the present invention, a connection device is provided between the pair of armrests and the head guard so that the head guard is oriented substantially perpendicular to the front side surface of the backrest when the backrest is at its most reclined position.

By this structure, the head guard will take an orientation substantially perpendicular to the front side surface of the backrest when the vehicular child safety seat is set to a bed position with the backrest at the most reclined state. The child using the vehicular child safety seat will be enclosed by the head guard, the pair of side guards, and the pair of armrests to be able to be protected at a high safety level.

In the above vehicular child safety seat, the connection device preferably includes a connection bar having one end rotatably connected in the proximity of the lower end of the head guard and another end accepted in a rotatable and slidable manner in a guide elongated aperture provided in the armrest. The guide elongated aperture includes a first elongated aperture portion provided to gradually approximate the support point so that the head guard is oriented substantially perpendicular to the front side surface of the backrest portion when the backrest is at its most reclined position, and a second

elongated aperture portion of an arc shape provided continuous to the first elongated aperture portion and on the circumference centered about the support point so that the head guard gradually becomes substantially flush with the backrest as the backrest is moved to its upright position.

By this structure, the head guard that is oriented substantially perpendicular to the front side surface of the backrest when in a bed-like state can be gradually rendered coplanar with the backrest according to the mechanical structure in the transition of the backrest from the most reclined state to an upright state.

In another aspect of the vehicular child safety seat of the present invention, the seat device includes a reclining mechanism for selectively altering the tilted angle of the backrest relative to the seat bottom between the position where the backrest is most reclined with the seat bottom and the backrest substantially in a flat state to form a bed plane on which a child is to be laid and the position where the backrest takes the most upright position for the child to take a seating posture.

By this structure, the tilted angle of the backrest to the seat bottom can be selectively altered to provide a comfortable posture for the child.

Preferably, the reclining mechanism includes at least two engagement holes in the armrest, an engagement pin provided at the inner side of the side guard and biased so as to be inserted into the engagement hole at a normal state by a resilient member, and a release handle provided at the backside of the backrest for releasing the bias of the engagement pin by the resilient member.

By this structure, the tilted angle of the backrest relative to the seat bottom can be selectively altered in a more preferable manner.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing a schematic structure of a child seat according to a first embodiment of the present invention.

Fig. 2 is an exploded perspective view showing a structure of the child seat according to the first embodiment of the present invention.

Figs. 3-5 show respective use positions of the child seat according to the first embodiment of the present invention.

Figs. 6-8 respectively show the reclining mechanism of the child seat according to the first embodiment of the present invention.

Figs. 9-11 respectively show a rotation lock device of the child seat according to the first embodiment of the

present invention.

Figs. 12-15 respectively show a mechanism to prevent reclining of the backrest of the child seat according to the first embodiment of the present invention.

Figs. 16 and 17 respectively show an entire structure of a child seat according to a second embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

### First Embodiment

A vehicular child safety seat according to a first embodiment of the present invention will be described hereinafter with reference to the drawings. First, the structure of a vehicular child safety seat (simply referred to as "child seat" hereinafter) 1 of the first embodiment will be described with reference to Figs. 1 and 2.

In child seat 1, the surface of the members constituting child seat 1 are generally covered with a member, for example urethane foam, to absorb any impact to ensure comfort and safety features. However, child seat 1 is illustrated in the drawings without the urethane foam in the present embodiment for better understanding of the structure of child seat 1. A child seat with urethane foam will be described in the subsequent second embodiment (Figs. 16 and 17).

Referring to Fig. 1, child seat 1 includes a seat device 1A, a support device 1B, and a base 1C.

Seat device 1A includes a seat bottom 16, and a backrest 11 hingedly connected at the rear end side of seat bottom 16 via a hinge member 18 in a reclinable manner. A pair of side guards 12 and 13 are provided at both sides of backrest 11, extending substantially perpendicular to backrest 11. A head guard 11 is connected to the upper end of backrest 11 via a hinge member 19 in a manner rotatable forwardly and backwardly to an angular orientation.

Support device 1B includes a pair of armrests 14 and 15 arranged at the inner side and in close proximity to the pair of side guards 12 and 13, and a connection plate 21 (refer to Fig. 2) connecting the lower ends of the pair of arm rests 14 and 15. Base 1C maintains support device 1B rotatably in the horizontal direction by means of a hold device (described subsequently).

Child seat 1 includes a crotch belt 17 that extends beneath the crotch of the child supported in child seat 1 upwards to firmly retain the child. A pair of shoulder belts provided extending from above both shoulders of the child and a pair of lumber belts supporting the lumber portion of the child will be described together with crotch belt 17 in the subsequent second embodiment (Figs. 16 and 17).

The structure of child seat 1 will be described in further detail with reference to Fig. 2.

Seat device 1A and support device 1B are connected by means of a pin bolt 34, a washer 35 and a nut

36 so as to couple bolt holes 33, 33 provided in armrests 14 and 15 as the support points and bolt holes 37, 37 in side guards 12 and 13 functioning as support points.

The pair of side guards 12 and 13 and the pair of arm rests 14 and 15 are arranged to have respective portions overlap each other at the neighborhood region of bolt holes 33, 33 and bolt holes 37, 37.

By this structure, the side portion of a child user will be protected by a double structure of at least side guards 12 and 13 and armrests 14 and 15. The safety at the time of a car accident such as a collision or crash when child seat 1 is used as a bed in a transverse position can be improved.

Guide protuberances 16a and 16b are provided at both side faces of seat bottom 16. Protuberances 16a and 16b are attached so as to fit into a guide groove 32 of a block 31 provided at the inward side of armrests 14 and 15. This causes seat bottom 16 to be gradually shifted backwards along guide groove 32 when backrest 11 of seat device 1A pivots frontward about pin bolt 34.

Crotch belt 17 is attached to a recess 23 provided in connection plate 21 of support device 1B by means of a bolt (not shown) through a through opening 16c in seat bottom 16.

By this structure, seat bottom 16 slides backward as backrest 11 is moved to its upright position. However, the space between backrest 11 and crotch belt 17 becomes wider since crotch belt 17 is fixed to connection plate 21. The child will not feel any oppressive sensation even when moved from a lying position to a sitting position where the crotch belt is used in a more preferable manner as a five point seat belt together with the pair of shoulder belts and the pair of lumber belts (second embodiment: Figs. 16 and 17). Therefore, the child can maintain a comfortable position.

An engagement pin 13b is attached to a fix plate 13a at the inner side of side guards 12 and 13 to adjust the tilted angle of backrest 11. Engagement pin 13b is biased so as to always protrude frontwards by a spring 13c. One end of a wire 13d is connected to the trailing end of engagement pin 13b. The other end of wire 13d is threaded through an opening 11a in backrest 11 to be connected to a reclining lever 43 (refer to Fig. 6) provided at the backside of backrest 11.

Engage holes 25a, 25b, 25c and 25d for receiving engagement pin 13b are provided at the trailing end sides of armrests 14 and 15. Engage holes 25a-25d are provided in a reinforcement plate 29. Reinforcement plate 29 is provided at the trailing end side of armrests 14 and 15.

In the state where engagement pin 13b is fitted in engage hole 25d, seat bottom 16 and backrest 11 are substantially in flush taking a horizontal flat state to form a bed plane. In the state where engagement pin 13b is fitted into engage hole 25a, backrest 11 is at its most upright position. The number of four engage holes provided in the is arbitrary. The tilted angle of backrest 11

can be selected arbitrarily according to the number of the engage holes.

Head guards 10 and the pair of armrests 14 and 15 are connected by a link bar 40. Link bar 40 has one end connected to a lower end portion 10a of head guard 10 in a rotatable manner, and the other end 40b fitted into a link guide elongated aperture 24 provided at the trailing end side of armrests 14 and 15 in a rotatable and swingable manner.

Head guard 10 is attached at the upper end of backrest 11 and supported rotatably by a hinge 19a secured to backrest 11 by a pin 19.

Link guide elongated aperture 24 includes a first aperture portion 24b provided to gradually approximate the support point implemented by bolt holes 33, 37 and pin bolt 34 so that head guard 10 is oriented substantially perpendicular to the front side surface of back rest 11 when back rest 11 is at the most reclined position, and a circular second elongated aperture 24a provided on the circumference about the support point and continuous to the first elongated aperture 24b so that head guard 10 becomes substantially coplanar with backrest 11 as backrest 11 is gradually moved to its upright position.

The reclining operation of child seat 1 and the rotatable motion of head guard 10 that cooperate with the reclining operation will be described afterwards.

The mounting of support device 1B that supports seat device 1A onto base 1C will be described hereinafter. An opening 22 is provided at the substantial center portion of connection plate 21 of support device 1B. Support plate 30 is fastened to base 1C through opening 22 by threading in a screw (not shown) into screw holes 20b of base 1C. Here, support plate 30 is positioned by a convex portion 20c provided on fix plate 20a. Support device 1B sandwiched by support plate 30 and base 1C is rotatable in a horizontal plane along a groove 20g provided in base 1C. A seat belt fixation groove 20f for engaging the seat belt with which the vehicle is equipped is provided in base 1C.

A lock device insert hole 20d for receiving a rotation lock device 50 for immobilizing the rotation of support device 1B is provided at the front side of base 1C. Support device 1B takes a locked position by threading lock pin 51 of lock device 50 through hole 20e to engage with a lock hole 20i provided in support device 1B (refer to Figs. 9 and 10). The details of the mechanism of rotation lock device 50 will be described afterwards.

Various use positions of child seat 1 of the above-structure are shown in Figs. 3-5. Child seat 1 is fastened to a seat 120 of a vehicle by means of a seat belt 121 with which the vehicle is equipped.

A typical mounted state is shown in Fig. 3. While base 1C is fixed to seat 120 by means of seat belt 121, support device 1B is rotated 90 degrees relative to base 1C to take a transverse state. Backrest 11 is reclined to its full extent, whereby seat device 1A takes a bed state (W1 specification). The safety of a child can be main-

tained with the child taking a lying posture.

Referring to Fig. 4, backrest 11 is moved in the upright direction with base 1C still immobilized. Support device 1B is rotated relative to base 1C so as to face the rearward direction. This will allow an infant of about 3 months to about 10 months that can hold his/her head firmly on its own to face the person such as the mother seated adjacent thereto. Also, this provides a safety seat position at the time of a crash for babies of this age. Figs. 4 and 5 correspond to the W2 specification.

Fig. 5 shows the state where support device 1B is fixed to base 1C so that the occupant faces frontward. A comfortable seat is provided for infants of above 10 months.

Figs. 6-8 are diagrams for describing the reclining mechanism of seat device 1A and the movement of head guard 10 to an upright position in cooperation with the reclining mechanism.

Fig. 6 shows the state where backrest 11 is at its fullest reclined state. This forms the optimum bed plane on which a child can be laid. Engagement pin 13b fits into engage hole 25d provided in armrests 14 and 15. The lower end portion 40b of link rod 40 is located at the terminal end of first elongated aperture 24b of link guide elongated aperture 24. Therefore, lower end 40b is immobilized even when backrest 11 takes a pivot motion.

In comparison with the state shown in Fig. 8 where backrest 11 takes the most upright position, link rod 40 is urged upwards at the terminal end of first elongated aperture 24b. Head guard 10 pivots about hinge 19a to be oriented substantially perpendicular to backrest 11. As a result, backrest 11 is enclosed by side guards 12 and 13 and head guard 10. The safety of the child supported in the child seat can be ensured.

In the state shown in Fig. 6, reclining lever 43 attached to backrest 11 via a rotary axis 43a in a manner rotatable in the upward and backward direction is lifted in the direction indicated by arrow A. In response, wire 13d is pulled in the direction indicated by arrow B in the drawing, whereby engagement pin 13b is pulled out of engagement with engage hole 25a. Here, backrest 11 is pivotable about pin bolt 34, so that backrest 11 can be moved to a more upright position as shown in Fig. 7. By releasing reclining lever 43 at this time point, engagement pin 13b will be fitted into engage hole 25c by the bias of spring 13.

At the same time, seat bottom 16 slides backwards along seat guide groove 32. Lower end portion 40b of link rod 40 is located at second elongated aperture portion 24b of link guide elongated aperture 24. Head guard 10 is oriented relative to back rest 11 from the state shown in Fig. 6.

From the state shown in Fig. 7, reclining lever 43 is pulled upwards to disengagement pin 13b from engage hole 25c. Backrest 11 is moved in a further upright position. Backrest 11 takes the most upright position when engagement pin 13b is fitted into engage hole 25a. Seat

bottom 16 is further moved backwards along seat guide elongated aperture 32.

By providing seat guide elongated aperture 32 so as to gradually extend downwards and frontward, seat bottom 16 is tilted frontwards to provide a comfortable bed plane for the child.

When backrest 11 is to be reclined, the tilted angle of backrest 11 can easily be adjusted by a procedure opposite to that described with reference to Figs. 6-8.

Stoppers 40S and 10S that are engaged at the lower ends of a bent portion 40a located midway of link rod 40 and head guard 10 are preferably provided so that head guard 10 can be pivoted smoothly when backrest 11 is moved to an upright position.

The mechanism of rotation lock device 50 for immobilizing support device 1B relative to base 1C will be described hereinafter with reference to Figs. 9 and 10.

Fig. 9 shows the state where support device 1B is fastened to base 1C. A lock pin 51 has its lower end engaged into a guide groove 54 in lock plate 52 and the upper end fitted in a lock hole 20i provided in support device 1B.

Lock plate 52 is constantly pulled in the backward direction by the bias of a spring 53 having one end engaged with the rear end of lock plate 52 and the other end anchored to an engagement portion 20h provided in base 1C. As a result, lock pin 51 is always fitted into lock hole 20i provided in support device 1B.

By pulling out a pull plate 55 provided at the leading end of lock plate 52 in the direction of A, lock pin 51 is shifted gradually in the direction of arrow B along guide groove 54. In response, the engagement of lock pin 51 with lock hole 20a is released as shown in Fig. 10, so that base 1C can rotate freely. In a normal state, lock pin 51 is fitted into lock hole 20i, so that rotation lock device 50 always operates to take a safety state.

The mechanism of allowing backrest 11 to be reclined when seat device 1A takes a transverse position, and for preventing reclination of backrest 11 at an attempted to recline backrest 11 when seat device 1A takes a position other than the transverse position will be described hereinafter with reference to Figs. 11-15.

As shown in Fig. 11, an engagement projection 11e is provided in the proximity of the lower end at the backside of backrest 11. Support plate 30 (refer to Fig. 2) includes a concave groove 30c that extends transversely for receiving engagement projection 11e to allow reclination of backrest 11 when seat device 1A takes a transverse position, and abutment faces 30a and 30b to prevent reclination of backrest 11 by abutting against engagement projection 11e when an attempted to recline backrest 11 is made when seat device 1A takes a position other than the transverse state.

This mechanism is shown more specifically by Figs. 12 and 13 which are partially enlarged vertical sectional views at the neighborhood of the lower portion of backrest 11 when seat device 1A takes a frontward facing or backward facing state. When an attempt is made to

recline backrest 11 at the state shown in Fig. 12, engagement projection 11e provided at the lower end of backrest 11 abuts against abutment faces 30a or 30b at an area A shown in Fig. 13 to prevent backrest 11 from reclining.

Figs. 14 and 15 are partial enlarged vertical sectional views at the neighborhood of the lower end of backrest 11 when seat device 1A is in the transverse state. As backrest 11 is reclined from the state shown in Fig. 14, engagement projection 11e provided at the lower end of backrest 11 is received in concave groove 30c to allow reclination of backrest 11 as shown in Fig. 15. Here, engagement projection 11e also has the side-wall portion thereof substantially accommodated in recess groove 30c, whereby the rotation of seat device 1A relative to base 1C is suppressed.

This mechanism of preventing reclining of backrest 11 when in the frontward facing or backward facing position provides the following advantages. When child seat 1 is used as a backward facing infant seat, the mechanism can be realized of preventing the maximum tilted angle of backrest 11, i.e., the angle between the surface of the backrest and the vertical plane, from exceeding 60 degrees taking into consideration the rebound of the vehicular child safety seat at the time of a crash. When seat device 1a is used as a bed in a transverse state, rotation of seat device 1A relative to base 1C can be suppressed to further increase the safety when used in a bed position.

Thus, child seat 1 of the present embodiment can meet the safety standards for W1 and W2 in accordance with the Japanese Industrial Standard (vehicular equipment-child protection apparatus: JIS-D 0401-1996) regulations.

Although engagement projection 11e is provided at backrest 11 and concave groove 30c and abutment faces 30a and 30b are provided at support plate 30 in the above-described structure, a similar function can be implemented by providing a concave groove at the part of backrest 11 and an engagement projection at support plate 30.

According to child seat 1 of the present embodiment, backrest 11 is connected to seat bottom 16 in a reclinable manner, and seat bottom 16 and backrest 11 can form a substantially horizontal plane for a bed when backrest 11 is at its most reclined position. When a child is laid in child seat 1 in this position, the child can be supported in the vehicle in a safety and comfortable position.

## Second Embodiment

A vehicular child safety seat according to a second embodiment of the present invention will be described hereinafter with reference to the drawings.

A child seat 100 which is the vehicular child safety seat of the present embodiment has a cushion material attached to child seat 1 of the first embodiment shown in

Fig. 1. Referring to Figs. 16 and 17, child seat 100 further includes a pair of shoulder belts 114 and 115 and a pair of lumbar belts 117 and 118 to form a 5 point seat belt with crotch belt 17. The height of the pair of shoulder belts 114 and 115 can be adjusted by means of an adjustment aperture 125 provided at backrest 11 to allow the body of the child to be supported appropriately according to the body dimension of the child. In the drawings, components corresponding to those of child seat 1 of the first embodiment have the same reference characters denoted.

Fig. 16 is a perspective view of child seat 100 in the use position of a bed. Fig. 17 is a perspective view of child seat 100 in the use position of a seat.

Child seat 100 further includes a pair of head guards 107 and 108 that are inclinable towards the inner side to further improve the safety protection of the side of the head of a child.

It is to be understood that the embodiments disclosed herein are only examples in all issues, and not to be limited to the structure and operation shown. For example, the present invention is not limited to the above-described structure of the child seat 1 where support device 1B is attached rotatable to base 1C. A structure can be adopted where support device 1b and base 1C are detachable, and the orientation of support device 1B and base 1C can be altered as necessary. Also, a structure can be adapted where support device 1B is fastened to base 1C by providing a seat belt fixation groove 20f at two locations crossing each other in base 1C.

The reclining mechanism of backrest 11 is not limited to the disclosed mechanism. For example, the reclining mechanism disclosed in Japanese Patent Laying-Open No. 7-17312, for example, or a reclining mechanism employing other various well known art can be adapted.

Since child seat 1 of the present invention is postulated to be used by children of all ages such as a newborn baby to children of the school age, appropriate mechanism for altering the distance between side guards 12 and 13, the distance between armrests 14 and 15, the position of head guard 10 with respect to backrest 11 according to the body dimension of babies, infants, and children can be adapted to suitably fit the child.

Also, a mechanism can be adapted to increase the thickness of the pair of side guards 12, 13 and armrests 12 and 14 and also increase the overlapping area between a side guard and an armrest to further improve the safety of a small baby when used in the bed position shown in Fig. 3.

Furthermore, the child seat of the present invention can be used in a manner having seat device 1A removed and using support device 1B and base 1C for W3 and covering support device 1B with a cushion member and the like. Thus, the child seat of the present invention can be used consistently in common corre-

sponding to the W1 specification to the W3 specification.

Although not illustrated, the cushion member of Figs. 16 and 17 can have appropriate grooves provided at the surface of the cushion member to improve the passage of air of the area in contact with the cushion member to improve the comfortness of the child held in the child seat.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.

## Claims

1. A vehicular child safety seat fixed to a seat of a vehicle using a seat belt with which the vehicle is equipped, comprising a support plane for accommodating a child,

wherein said support plane is provided in selectable positions of:

a state of forming a bed plane enclosing a head portion and a side portion of the child to lay said child transverse to a direction of travel of said vehicle, and

a state of forming a seat plane for seating said child facing frontwards or backwards with respect to the direction of travel of the vehicle.

2. The vehicular child safety seat according to claim 1, wherein said support plane is constituted by seat means including

a seat bottom,

a backrest provided reclinable relative to said seat bottom,

a pair of side guards extending from both sides of said backrest in a direction substantially perpendicular to a front side surface of said backrest, and

a head guard connected at an upper end of said backrest in a manner rotatable to an angular orientation relative to the front side surface of said backrest.

3. The vehicular child safety seat according to claim 2, further comprising:

support means including a pair of armrests inwardly and in close proximity to said pair of side guards for supporting said pair of side guards in a manner rotatable about a support point forwardly and backwardly, and a connection plate for connecting lower end portions of the pair of armrests, and



a base including hold means for holding said support means rotatable in a substantially horizontal direction.

4. The vehicular child safety seat according to claim 3, wherein said seat means is provided detachable with respect to said base. 5
5. The vehicular child safety seat according to claim 3, wherein said hold means includes 10
 

a circular convex portion provided at said base, an opening provided at said connection plate for receiving said convex portion, and a support plate for sandwiching said connection plate with said base, and fixed to said convex portion so that said connection plate is rotatable. 15
6. The vehicular child safety seat according to claim 5, wherein said hold means and said backrest are provided with backrest inclination limit means for allowing said backrest to be reclined when said seat means is in a transverse state, and preventing said backrest from reclining at an attempt to recline said backrest when said seat means takes a position other than said transverse state. 20 25
7. The vehicular child safety seat according to claim 6, wherein said backrest inclination limit means includes 30
 

an engagement projection provided at a neighborhood of a lower end portion at a backside of said backrest, and 35

a concave groove and an abutment face provided at said support plate, said concave portion extending in the transverse direction for receiving said engagement projection so that said backrest is reclined when said seat means is at the transverse state, and said abutment face preventing the reclining of said backrest by abutting against said engagement projection at an attempt to recline said backrest when said seat means takes a position other than said transverse state. 40 45
8. The vehicular child safety seat according to claim 7, wherein said engagement projection is accepted in said concave groove to prevent rotation of said seat means relative to said base when said seat means takes the transverse state. 50
9. The vehicular child safety seat according to claim 3, wherein said pair of side guards and said pair of arm rests are arranged to have a portion thereof overlap each other. 55

10. The vehicular child safety seat according to claim 3, wherein said seat bottom is supported by said pair of armrests so that said seat bottom slides towards said backrest as said backrest is moved to an upright position.
11. The vehicular child safety seat according to claim 10, wherein said seat bottom further includes a crotch belt fixed to said connection plate through an elongated aperture provided in said seat bottom in the sliding direction of said seat bottom.
12. The vehicular child safety seat according to claim 11, wherein said crotch belt forms a 5 point seat belt together with a pair of shoulder belts and a pair of lumbar belts for ensuring retaining of said child to said vehicular child safety seat.
13. The vehicular child safety seat according to claim 3, wherein said base further includes seat fixation means for selectively fixing a rotation position of said seat means with respect to said base.
14. The vehicular child safety seat according to claim 3, wherein said pair of armrests and said head guards include connection means for said head guard to be oriented substantially perpendicular to a front side surface of said backrest when said backrest is at a most reclined position.
15. The vehicular child safety seat according to claim 14, wherein said connection means includes a connection bar having one end connected rotatably at a neighborhood of a lower end of said head guard, and another end received rotatably and slidably in a guide elongated aperture provided in said armrest, wherein said guide elongated aperture includes
 

a first elongated aperture portion provided to gradually approximate said support point so that said head guard is oriented substantially perpendicular to the front side surface of said backrest when said backrest is in its most reclined position, and

a circular second elongated aperture portion provided continuous to said first elongated aperture portion and on the circumference centered about said support point so that said head guard is gradually substantially coplanar with said backrest as said backrest is moved in an upright position.
16. The vehicular child safety seat according to claim 2, wherein said seat means includes a reclining mechanism for selectively altering a tilted angle of said backrest with respect to said seat bottom between the position where said backrest is most reclined so

that said seat bottom and said backrest are substantially in a horizontal state for forming a bed plane to lay said child, and a position where said backrest is most upright to seat said child.

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17. The vehicular child safety seat according to claim 16, wherein said reclining mechanism includes at least two engage holes provided at said armrest,

an engagement pin provided at an inner side of said guide guard, and biased so as to be inserted in said engage hole by a resilient member, and  
a release handle provided at a backside of said backrest for releasing the bias by said resilient member to said engagement pin.

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FIG. 1

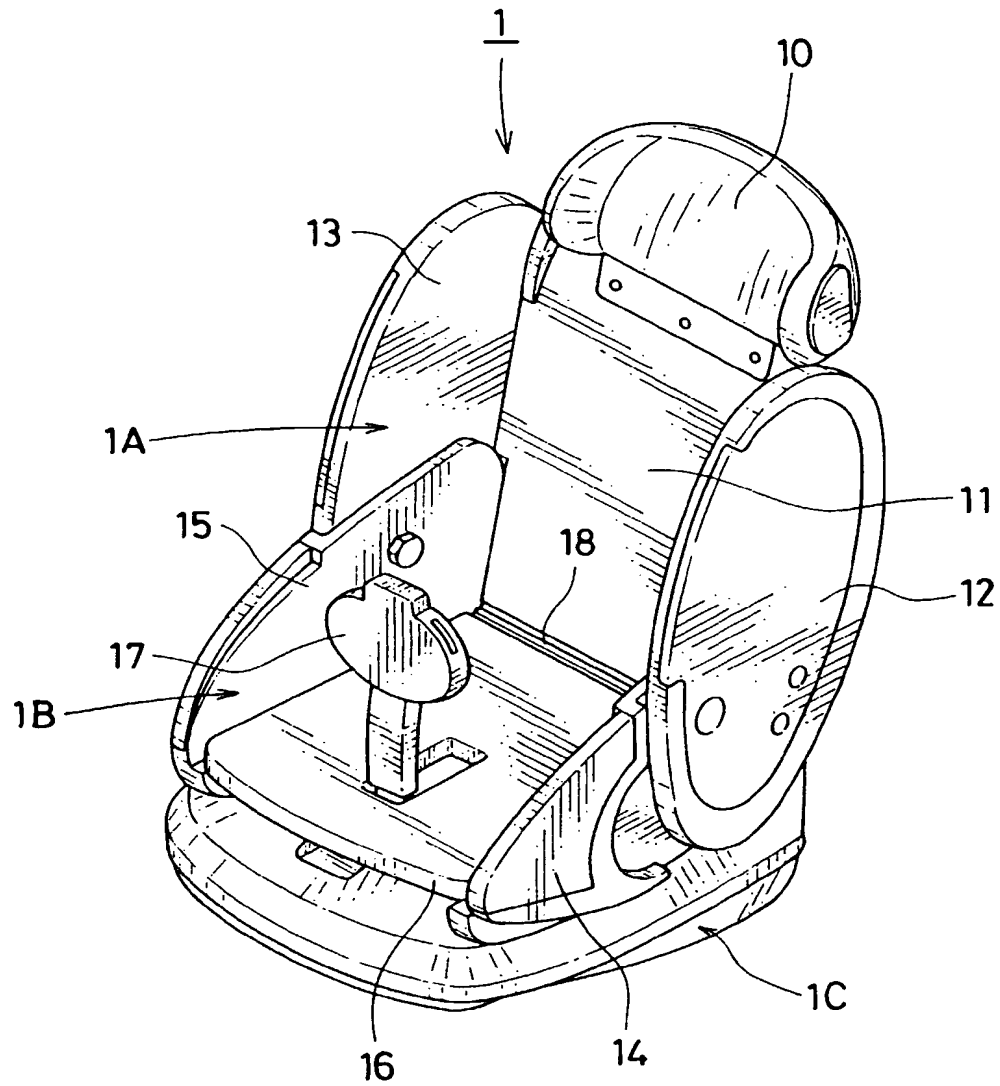


FIG. 2

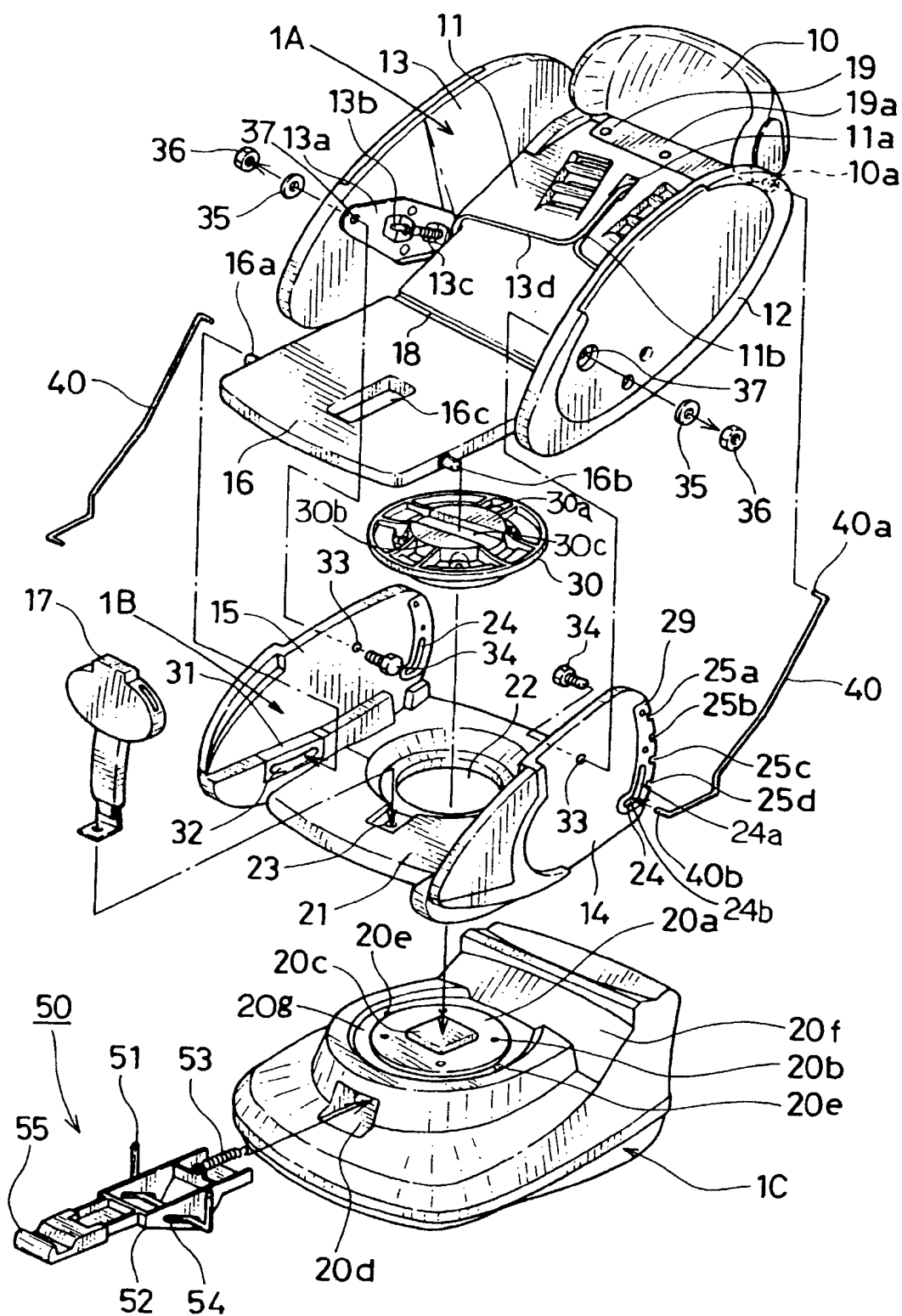


FIG. 3

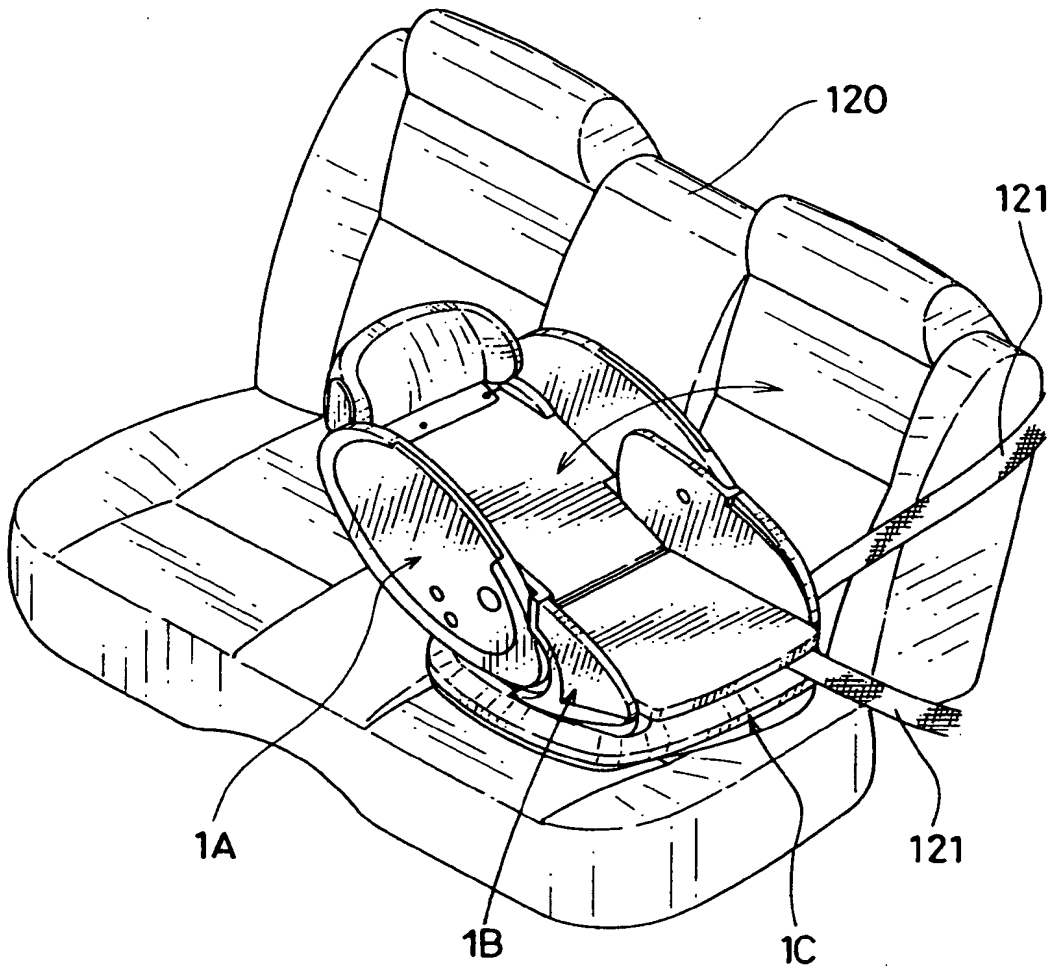


FIG. 4

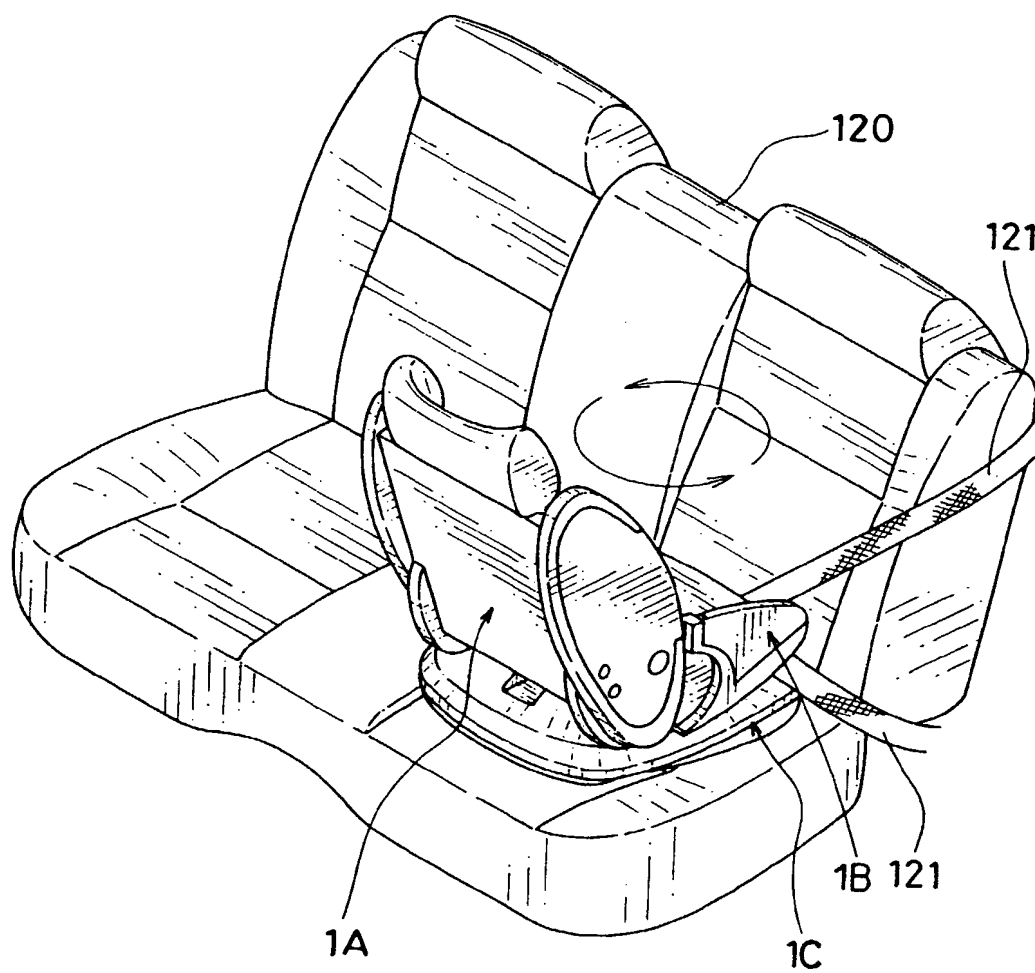


FIG. 5

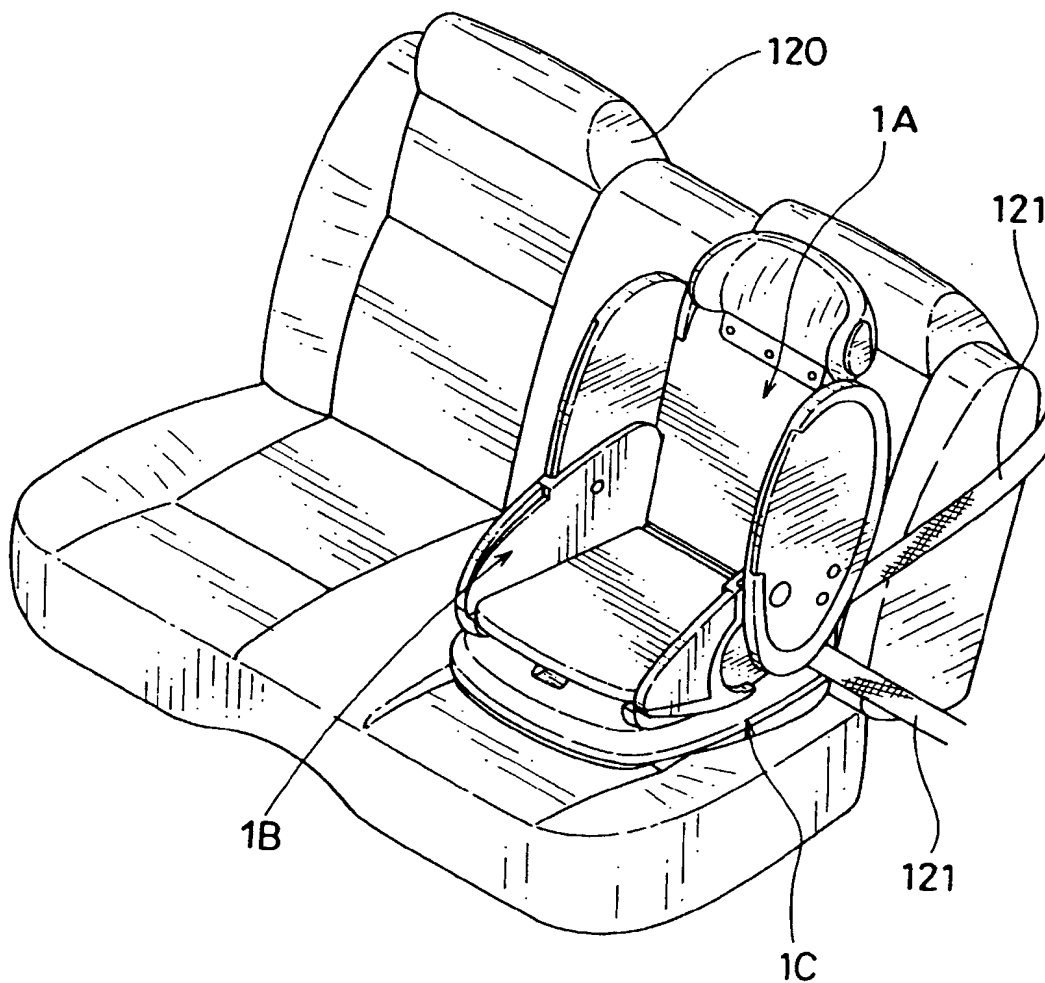


FIG. 6

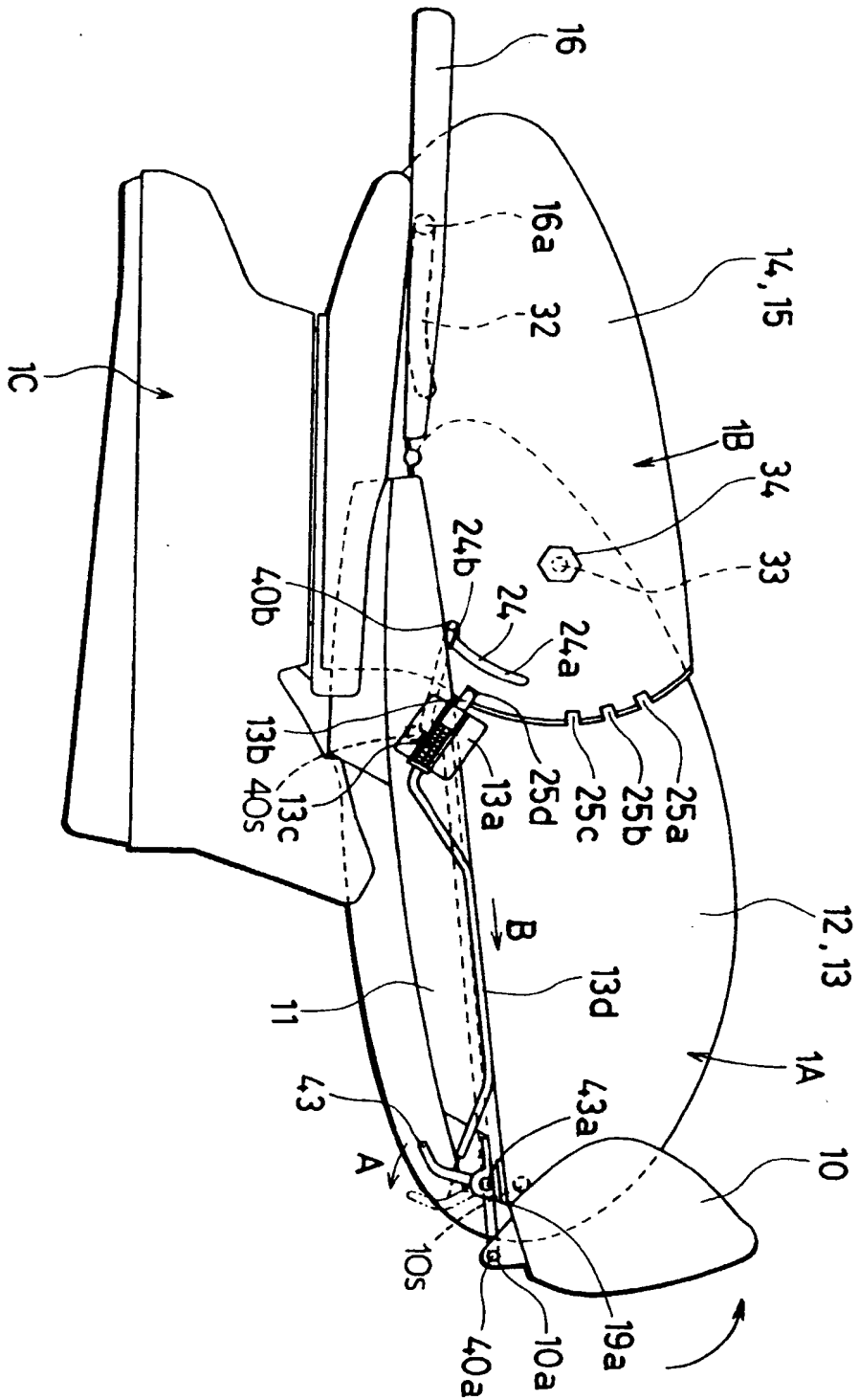




FIG. 7

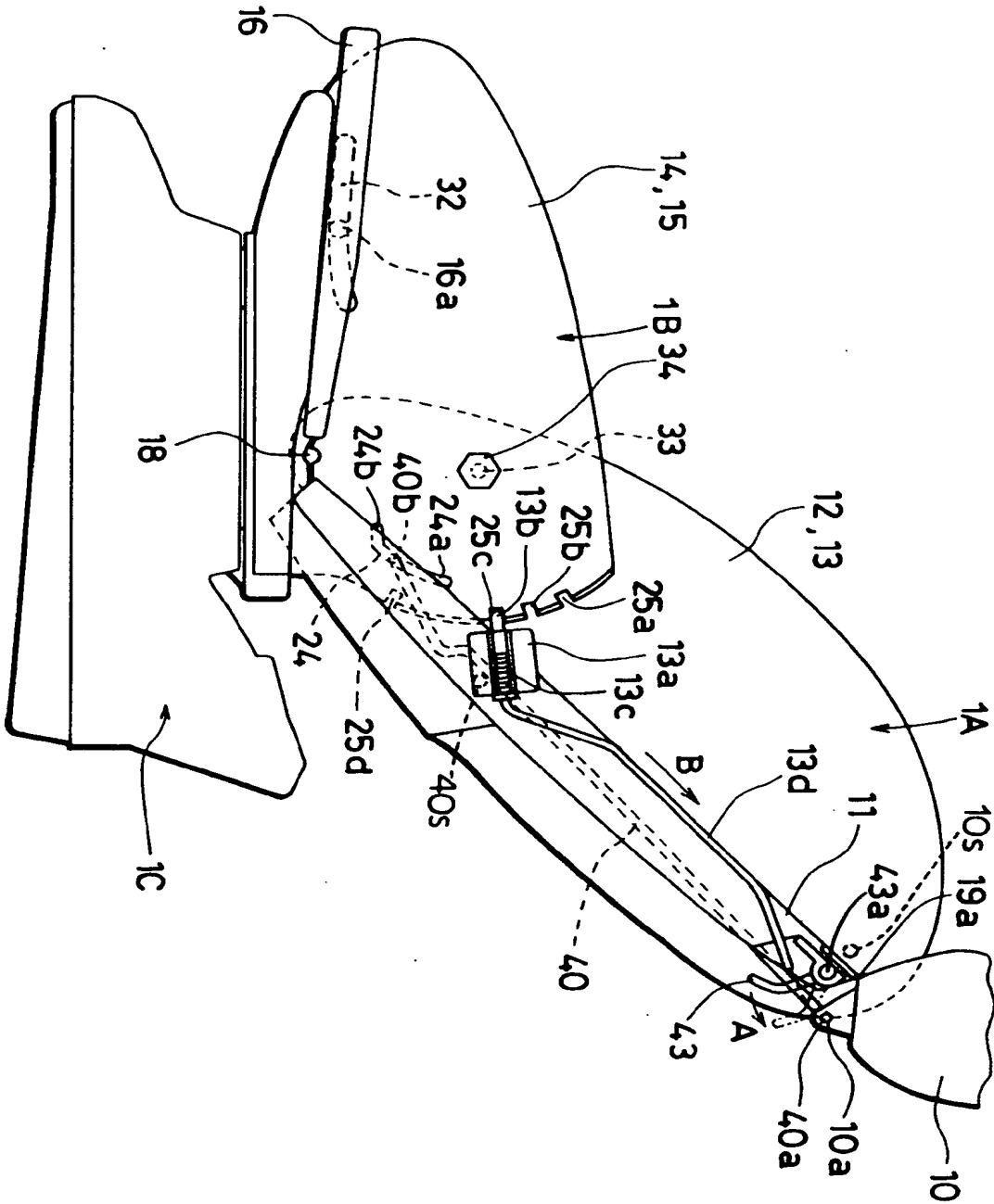


FIG. 8

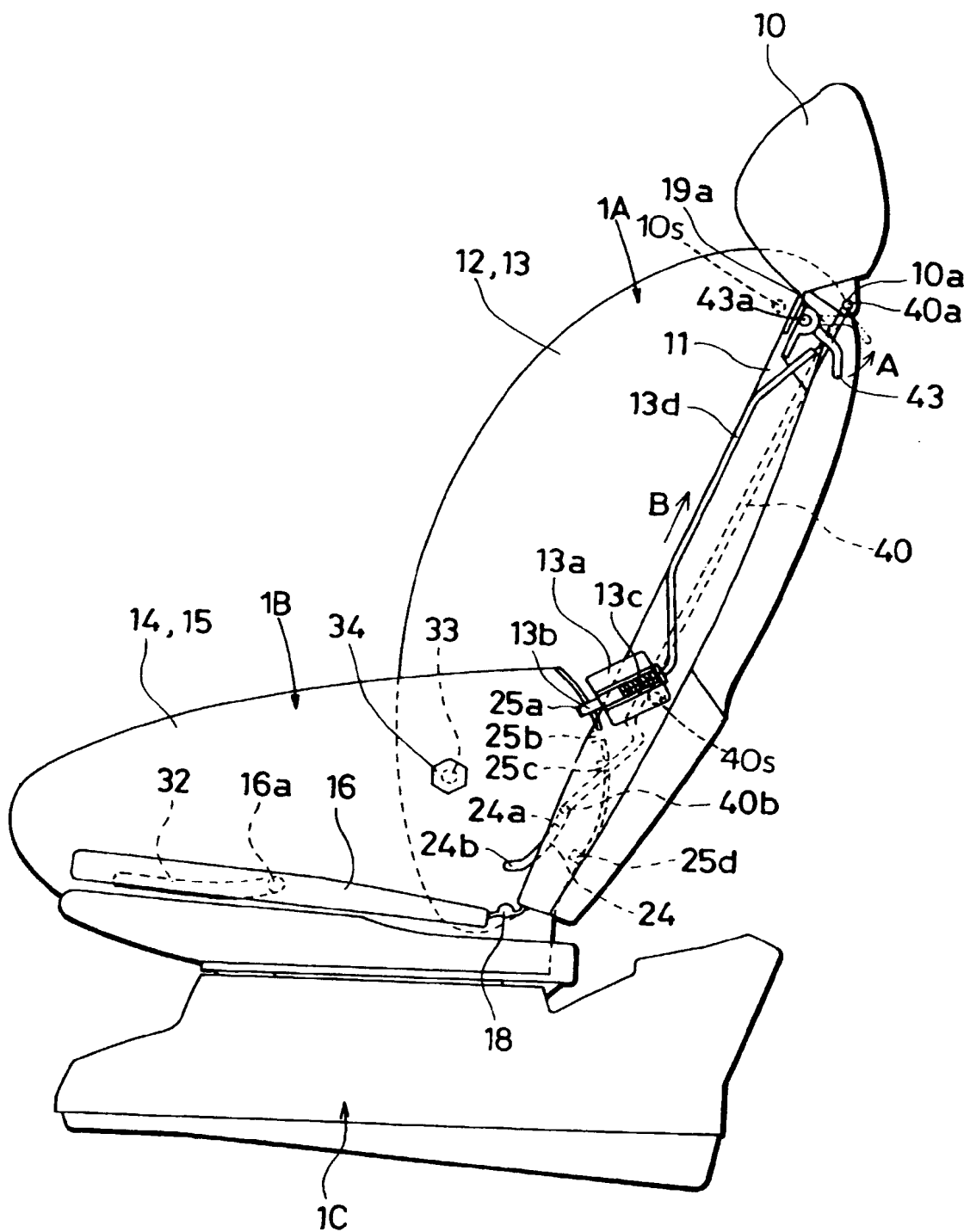


FIG. 9

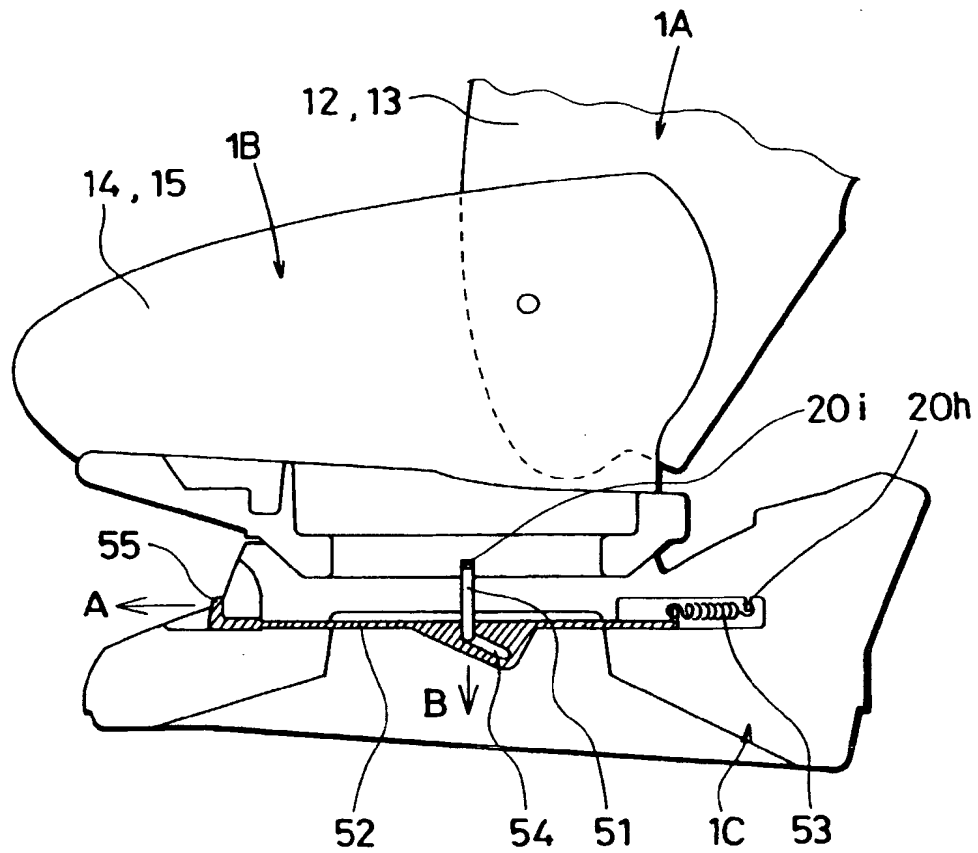


FIG. 10

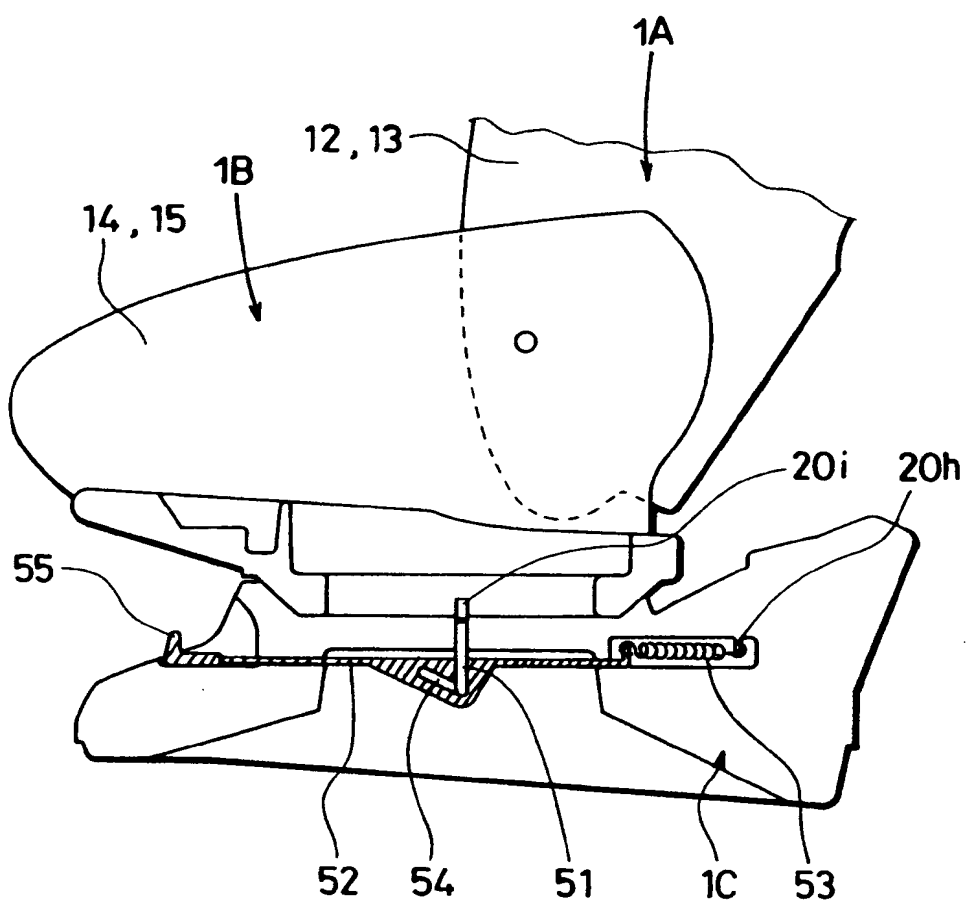


FIG. 11

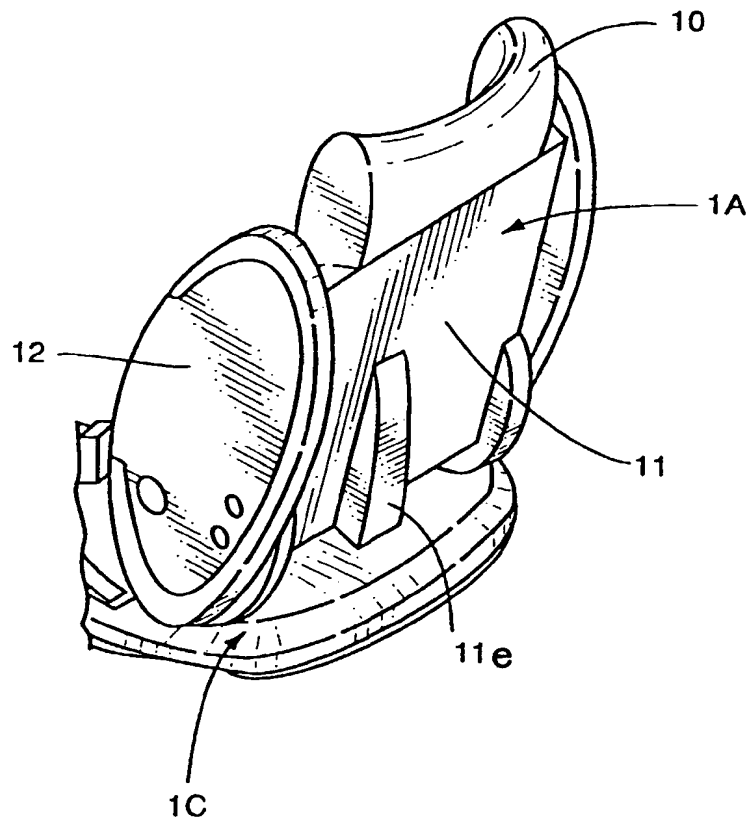


FIG. 12

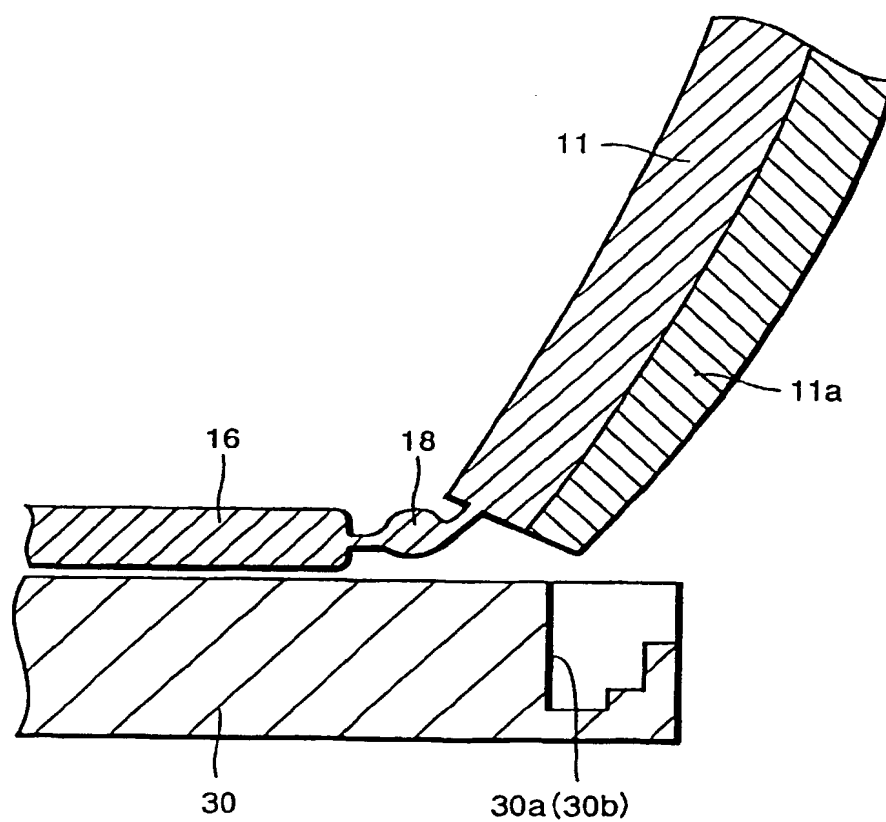


FIG. 13

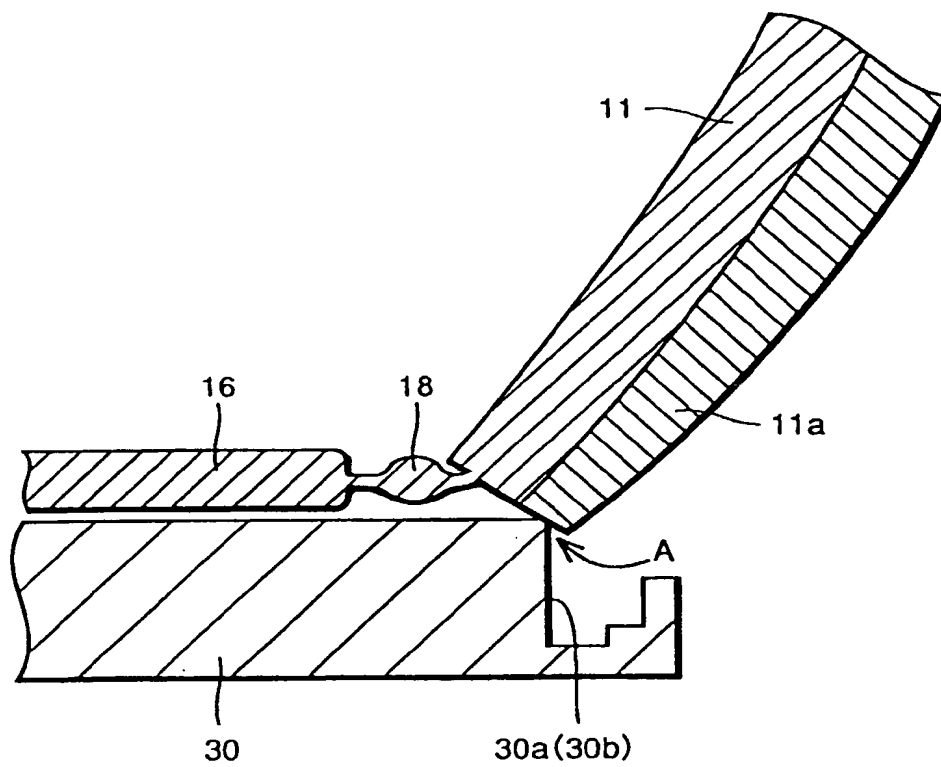


FIG. 14

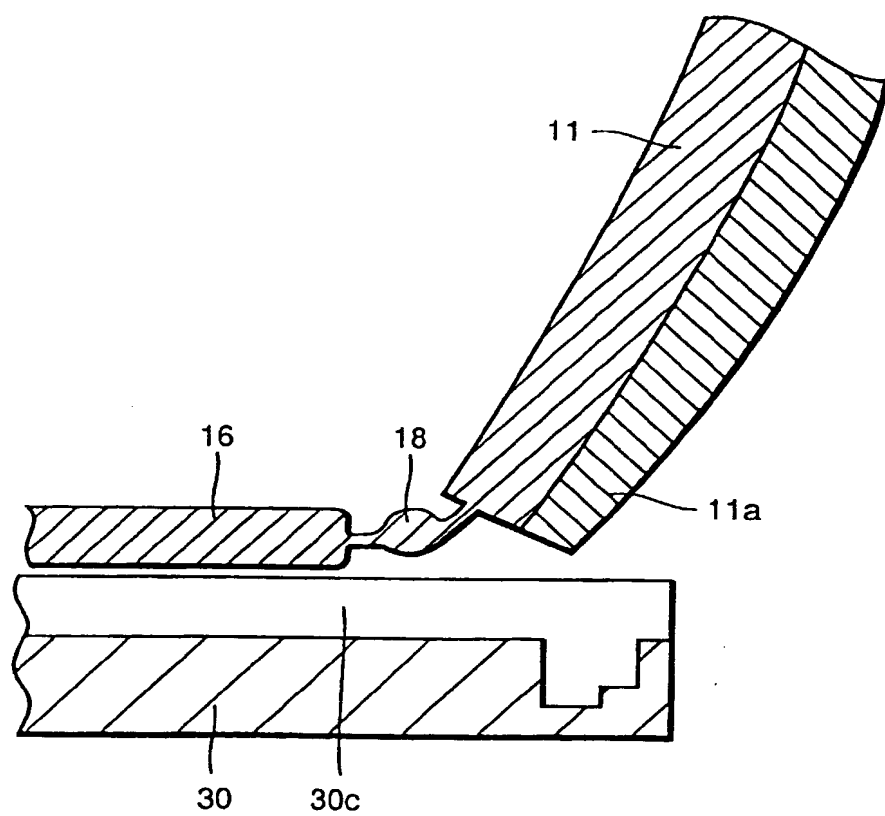




FIG. 15

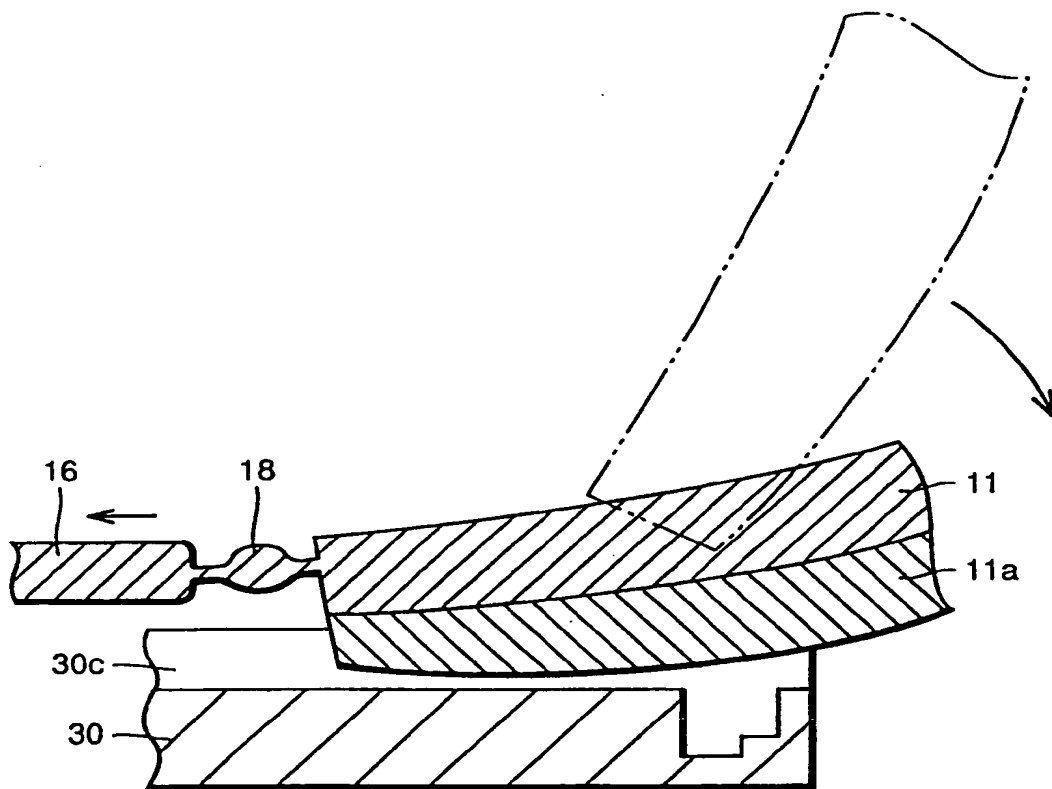


FIG. 16

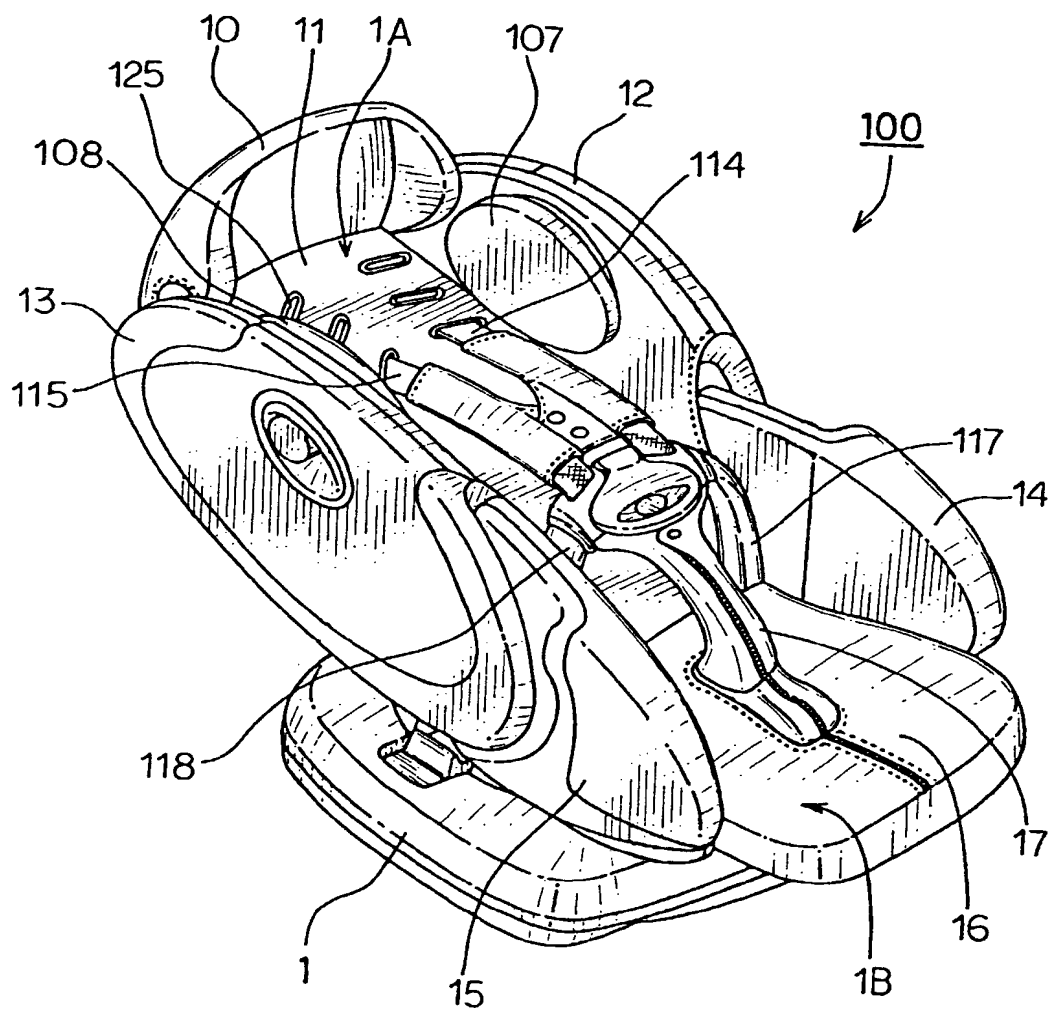
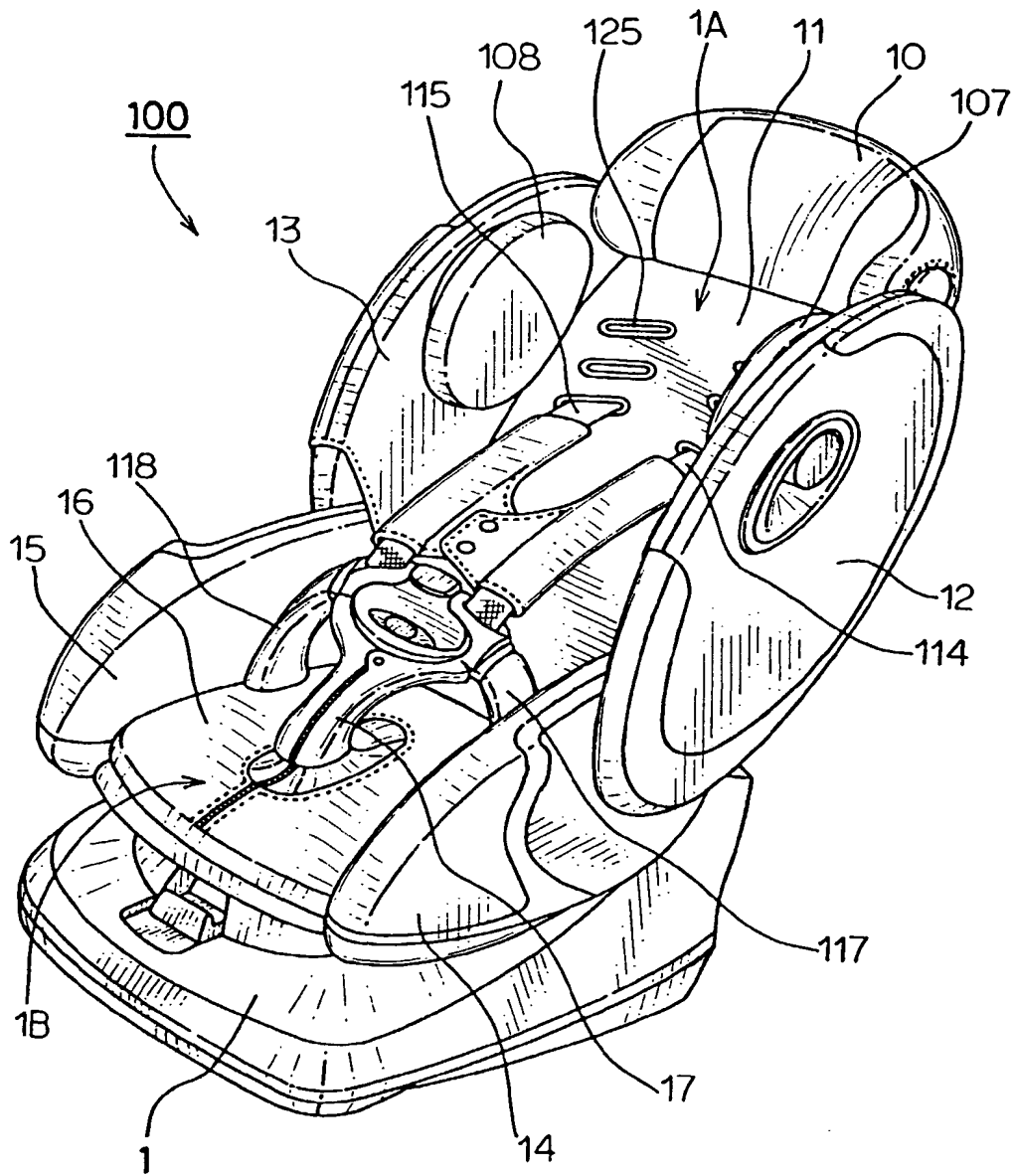


FIG. 17





European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 98 10 0028

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	WO 91 00193 A (UJVARI, AGNES ET AL.) * page 5, line 4 - page 9, line 20 *	1,13 2-6,10, 14-16	B60N2/28
X A	--- US 4 762 364 A (QUENTIN YOUNG) * abstract; claims 1,7,9; figures 1-5 *	1,13,16 2-7,11, 12,17	
A	--- EP 0 009 439 A (SOCIETE ANONYME DITE: BABY RELAX) * page 5, line 12 - page 6, line 20; figures 1-5 *	1,3,6,7, 9,14-17	
A	--- GB 2 256 364 A (ELECTROLUX KLIPPAN AB)  * abstract; figures 1-6 *	1,6, 10-12, 14,15	
A	--- EP 0 426 585 A (RENOLUX) * abstract * * page 1, line 1 - line 36; figures 1-3 *	1,3-8,13	
A	--- EP 0 631 903 A (APRICA KASSAI KABUSHIKIKAISHA) * abstract; figures 1-11 *	1,6,7,17	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B60N
The present search report has been drawn up for all claims			
Place of search <b>BERLIN</b>		Date of completion of the search <b>1 April 1998</b>	Examiner <b>Cuny, J-M</b>
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